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Choosing a database system for HANKAM department.

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CHOOSING A DATABASE SYSTEM
FOR HANKAM DEPARTMENT

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

CHOOSING A DATABASE SYSTEM
FOR HANKAM DEPARTMENT

by

Sudiyanto

December 1979

Thesis Advisor: N. F. Schneidewind

T192010

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Choosing a Database System for HANKAM Department		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; December 1979
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Sudiyanto		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE December 1979
		13. NUMBER OF PAGES 44
14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

MIS master plan, database systems, distributed systems, distributed data processing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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and guidance for the development which may improve support
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opment of the Armed Forces.

Choosing a Database System
for HANKAM Department

by

Sudiyanto
Lieutenant Commander, Indonesian Navy
IR., Pusat Pendidikan Ilmiah Angkatan Laut. 1976

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN COMPUTER SCIENCE

from the

NAVAL POSTGRADUATE SCHOOL
December 1979

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As time goes by, a Master Plan may be improved. The
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department and its subordinates, can be used as a long term
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support from and reduce future potential conflict with the
MIS development of the Armed Forces.

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I. INTRODUCTION

The basic characteristic of a computer is its capability
to provide useful information with a tremendous speed, by
manipulating a given set of data, in accordance with a
certain processing algorithm which is called a program. This
characteristic applies to all computer usage, although a
specific computer may have a different internal organization
and configuration.

Several computer applications in the organization which
refer to Automatic Data Processing (ADP) or Electronic Data
Processing (EDP) are:

1) Automation of office paper work or clerical work.

2) Providing information for monitoring and controlling
the activities at the operational level by the manage-
ment and for record keeping.

3) Providing information for supporting a decision making
process at the middle and upper management levels.

Generally the three applications are covered within one
organizational function which conducts the operation of the
information system of the organization.

The HANKAM/Armed Forces[1] is a complex nation wide
organization with roughly three hundred thousand people,

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[1]HANKAM/Armed Forces refers to HANKAM Department and
Armed Forces components. Armed Forces components are Army,
Navy, Air Force, and Police.

which is 0.2% of Indonesia's population. In using modern
management principles to cope with today's fast changing
environment, ADP services are needed. A great amount of
data originating from the activities of the sub-organizations
should be processed systematically. Frequently the manage-
ment does not have adequate information in terms of its
accuracy, completeness, timeliness, and consistency to
support their decision making process. On the other hand,
with the manual system, the staff officers are burdened with
a tremendous amount of paper work.

The data which are gathered at the HANKAM staff and
planning level come from five main sources, namely: Army,
Navy, Air Force, Police, and HANKAM Supporting Activity
Agencies. It is originated and generated in the operational
level of the organization. The data is gathered, filtered,
and summarized during its flow along the path of the organ-
ization hierarchical structure. Some are used in each
decision point within each hierarchical level to perform
their internal function.

Considering the ability of computers for data or string
manipulation and computing, the HANKAM Department decided to
improve its information system by using computer as a tool.
It is widely known that for an organization that possesses a
good management, a computerization of its information system
may improve further the performance of the organization. But
ADP may make poor management worse. Therefore an improvement
of the management function may be necessary prior to
computerization.

A master plan for the development is important in setting
the overall objectives. It gives directions to the evolution
of the development. While the current stage of the HANKAM
system development is mostly in the system identification,
system study, and system definition phases, this thesis dis-
cusses a proposed database system to support the existing
master plan. Hence it is assumed that the database system
has not been selected.

II. BACKGROUND

In 1967 the management of the HANKAM Department realized
the need for improving its information system. The idea of
having a computerized information system has been accepted.
The introduction of the system approach in managing an organ-
ization in the late 1960's and the economic development and
growth of the nation after 1966 contributed to the acceptance
of the idea. Since then several studies with regard to the
department MIS development plan have been conducted. As a
result, a master plan for the development was formulated in
1972 and approved in 1973.

Two major aspects of the master plan are the computer
with its information flow and operational research/system
analysis. This thesis has a close relation with the first
aspect.

In 1975 HANKAM ADP Centre with its computer, UNIVAC 1106,
was established. The current hardware acquisition was intended
primarily to support the preparation for future operation of
the information system. Currently it is used to process per-
sonnel and material census, to support training programs, to
gain experience and expertise in computer operation and pro-
gramming, and to being used for several computational
applications.

Organizationally, HANKAM ADP Centre is one of the many
HANKAM Supporting Activity agencies. The mission is to give

assistance to the HANKAM Minister/Commander in Chief in
managing the computer based HANKAM MIS and to perform data
processing and information presentation at the department
level. In 1976 similar agencies were established at head-
quarter level for the armed services. These agencies opened
formal channels for development coordination of the overall
system as well as initiating activity on the system development
at the armed forces level. What has to be done more is towards
the management of standardization problems. All parties
agree that ignorance of standardization will create inefficient
future system operation since most of the data for the HANKAM
department will be collected from the armed forces. But it
is hard to establish those standards without specifying in
more detail how the system will operate in the future.

The introduction of database processing gives further
insight into the problems. Developed countries who pioneered
in the use of computers in organization have suffered in try-
ing to convert their file processing system into a database
processing system. The conversion is intended for more re-
sponsiveness to management for ad hoc information requests,
data availability, integrity, and security. This experience
can be used by those who build a computerized information
system from scratch.

The standardization area for database software is mainly
in the data dictionary, as part of the schema, and database
management system (DBMS). However, future trends of the DBMS
development is still in question. The possibility of having

multiple database management systems (heterogeneous DBMS) is still under study [Ref. 1]. It is also influenced by hardware developments such as the back-end computer (database computer).

Before deciding on hardware and software standardization, the author thinks it is more important first to decide in the near future, whether the department should have a centralized data processing system, a distributed data processing system, or a distributed system. Each of the systems have different restrictions regarding standardization, software, hardware, and database systems.

III. DATABASE SYSTEMS

A. FILE PROCESSING vs DATABASE PROCESSING

1. File Processing System

File processing is designed for a specific application. It is usually efficient for the application but subject to data dependency. Storage structure of a file processing system is embedded or locked in its application program, which interacts with the operating system. A new application involving the same data or some of it:

1) Creates redundancy.

2) Needs to construct a new version of the same data.

3) Needs data reorganization and recoding.

The conversion is time consuming and needs a lot of effort. Nolan has a vignette [Ref. 2] which shows that it requires nine months to one year to have a new application utilizing available data from several other applications. Too many different application programs create data incompatibilities due to difficulties in the updating process. According to Martin [Ref. 3]:

> In a large data-processing operation without a data base there are so many redundant data that it is virtually impossible to keep them all at the same level of update. Too often the users or general management notice the apparent inconsistencies that this causes and distrust the computerized information. Inability to keep redundant data in the same state of update is a common cause of the anti-computer stories that managers too often tell.

The file processing system can be visualized as in figure 1. It is firstly used for routine processing and the difficulties arise when there is an ad hoc processing request.

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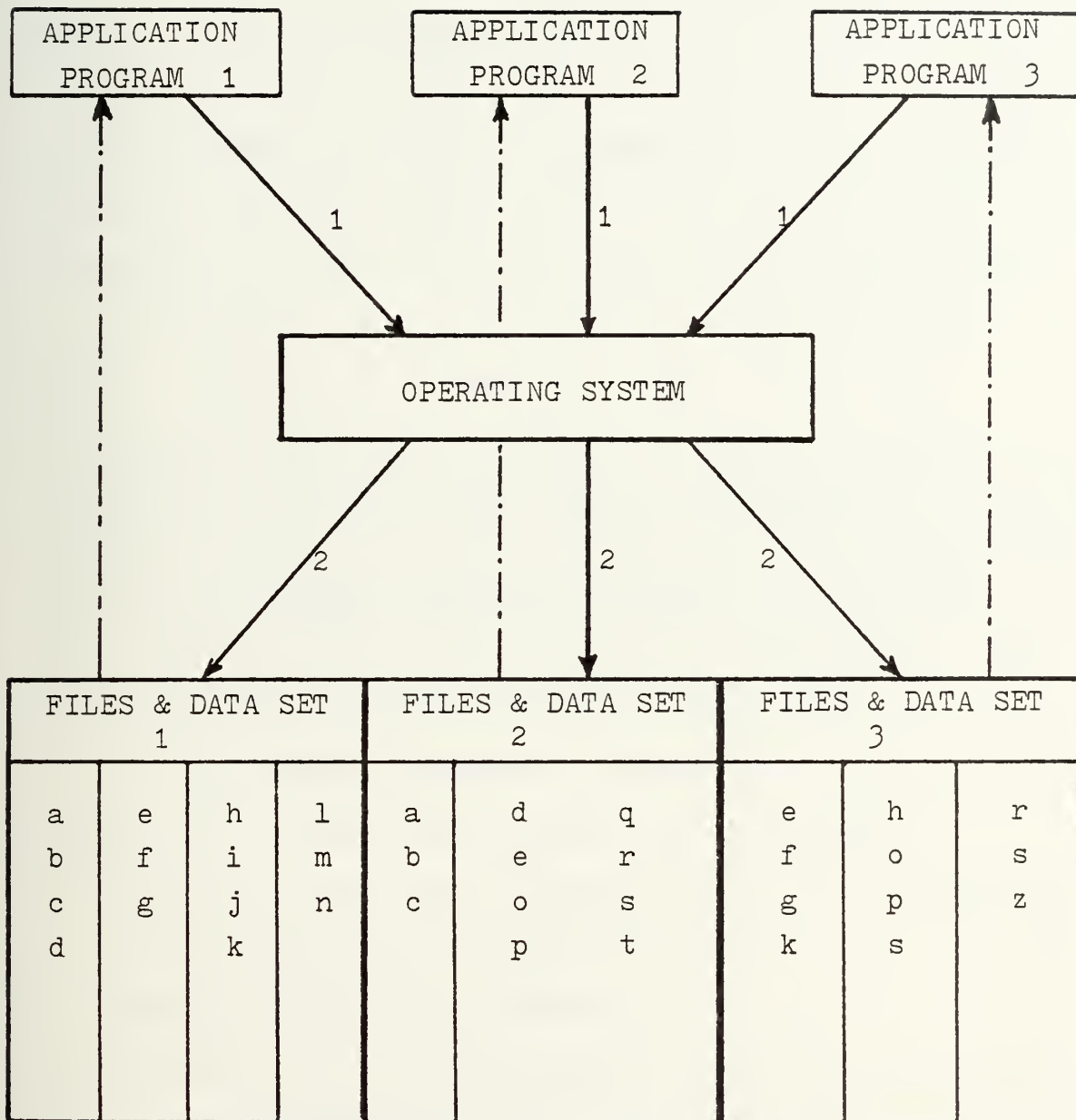
Figure 1. File Processing System.

2. Database Processing System

Too many problems arise with the file processing system as the demand for information processing moves upward towards the upper management levels. They usually have ad hoc request for processing the available data, which is already locked in other application programs, to produce different information for a new application. The file processing system cannot provide sufficient response to this request.

The database processing system solves the above problem. Martin defined that [Ref. 3]:

A collection of data designed to be used by different programmers is called a data base. We will define it as a collection of interrelated data stored together with controlled redundancy to serve one or more applications in an optimal fashion; the data are stored so that they are independent of programs which use the data; a common and controlled approach is used in adding new data and modifying and retrieving existing data within the data base. One system is said to contain a collection of data bases if they are each entirely separate in structure.

The database processing system can be visualized as in figure 2. It has the following characteristics:

1) Different application program used by the programmers see different data relations. The relation is called logical relation or subschema.

2) Those many different relations seen by the application programmers derived from a common overall relation that covers all data. It is called schema.

3) The schema should contain as many relations as possible as long as the relations will more likely be used.

4) The schema is independent of how data will be stored physically (physical database description).

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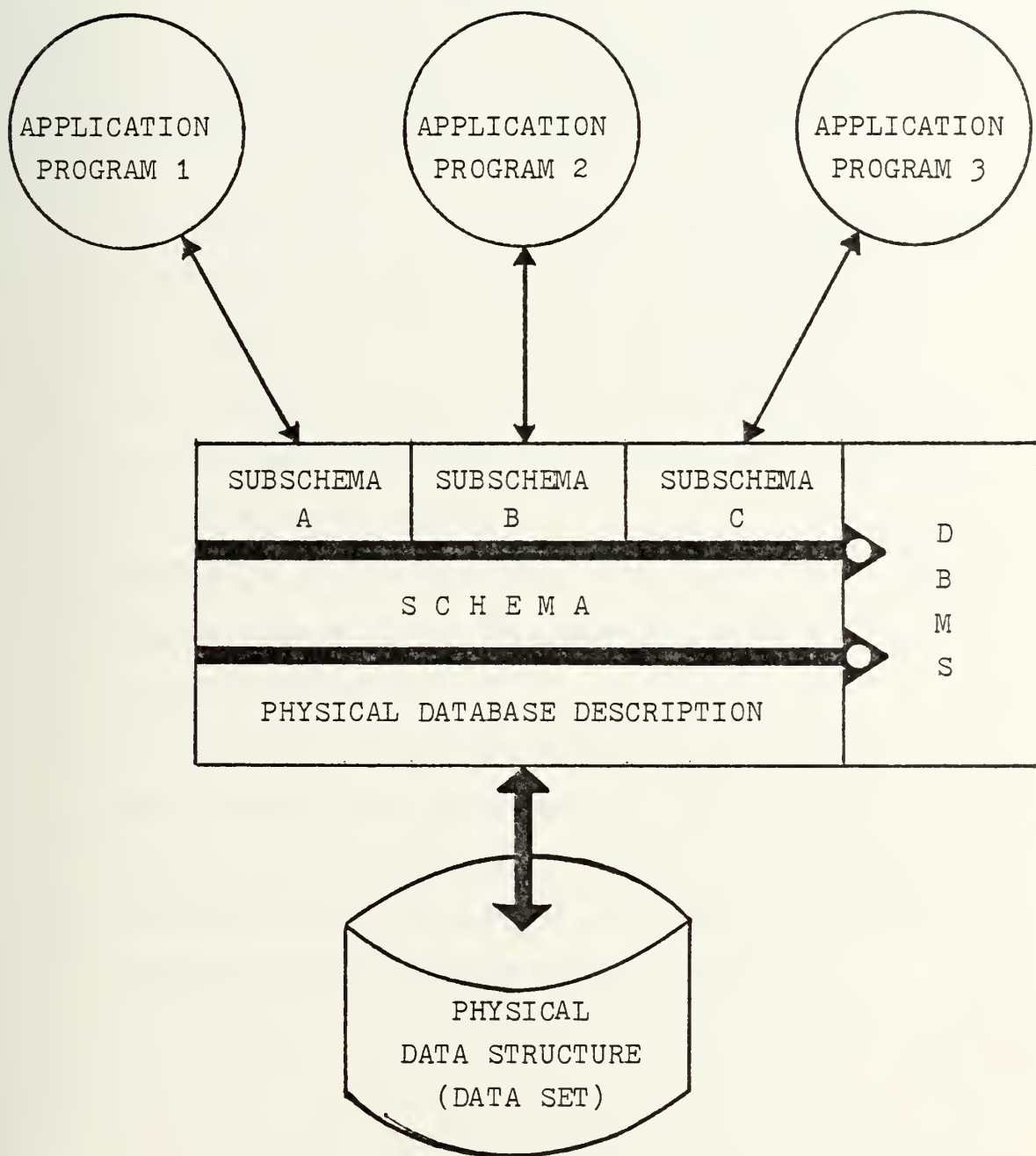
Figure 2. Database Processing System.

5) The mapping from subschema to schema and then to the physical database description is done by the database management system (DBMS) and vice versa.

6) To provide a reference to the physical path necessary to access a particular data element, a schema possesses a data dictionary or directory.

The advantages of database processing systems are:

1) Data integrity; ensures to some degree the accuracy and correctness of the data in the database.

2) Data sharing; ensures the use of the data elements in the database (data set) by multiple users without disturbing each other.

3) Data security; ensures the protection of the data set against unauthorized disclosure, alteration, or destruction [Ref. 4].

4) The evolution of several projected applications is possible through the growing of the schema without interferring with the existing application programs.

5) Databases that were separate can later be combined through database software standardization.

D. DATA PROCESSING SYSTEM AND DATABASE SYSTEM

Any large organization that has moved to computerize its
data processing functions usually acquires more than one
computer. The computing facility is usually dispersed
throughout the organization's decision points or functions.
The term "distributed data processing" applies when several
stand alone data processing systems exist to process infor-
mation when this is the most effective way to satisfy
operational, economical, or geographical conditions. In
distributed data processing, local computers can communicate
with each other and with a central computing facility through
the use of telecommunication facilities, but the processors
of the computers do not interact with each other, although
they may share storage devices.

A "distributed system" has been defined as one in which
there are several autonomous but interacting processors and/
or data stores at different geographical locations. However,
the physical distribution of hardware without dispersing the
processing function does not constitute a distributed system.
It does not necessarily imply that a local computer in a dis-
tributed system is unable to function as a stand alone data
processing facility. Distributed system is a new technology
especially when involving database system in it.

Centralized data processing is the antagonist of
distributed data processing. In centralized systems all work
is done at a processing center with remote users serviced
via data communication links.

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Two classes of distributed system can be identified:
hierarchically distributed and horizontally distributed. In
the hierarchically distributed system the processors share
tasks in a structured way with each component to some degree
controlled by the higher level members of the hierarchy. In
the horizontally distributed system all processors cooperate
at an equal level, logically, to perform a set of tasks. In
many cases, the computer systems are large-scale information
processors supporting local terminal systems. All of the
above terms were taken from Refs. 1 and 5.

Different classes of database systems exist in either a
hierarchical or horizontally distributed system. The classes
arise as a result of two considerations: data set objectives
and communication objectives. Data set objectives are con-
cerned with the control and effective usage of the
organization's informational resources. It is done through
the improvement of data integrity and data availability
(accessibility and sharing). Communication objectives are to
minimize the volume and path length of the communication
traffic.

The database system classification is determined by the
manner in which three major components of the database system
are organized such that the distributed system can perform
as a single total database system have the choices of dif-
ferent kinds of splitting the data set, different kinds of
splitting the directory (and possible also the schema), and
where to locate the programs (DBMS and user program). The

Table 1: Advantages and Disadvantages of Data Set distribution methods. Data Set refers to Data Base in the original copy.

Type of Distribution	Advantages	Disadvantages
Common data set accessed by all processors. (Centralized)	No duplication of data, little reorganization required.	Contention among multiple processors attempting to access data simultaneously. Data set is large, so response time is slow. During disk failures, all processors lose access to data.
Copy of the common central data set stored at each processor. (Replicated)	Each processor has access to data set without contention. Fast response time. During failure, new copy can be obtained.	High storage cost due to extensive duplication of data. Updates of one copy must subsequently be made on all other copies. High data set reorganization costs.
Individual data set for each processor in the ring. (Partitioned)	No duplication of data minimizes storage cost. Size of data set determined by application of node, not total corporate requirement. Fast response time.	Ad hoc or management reports must be obtained from different data sets.

choice of where to locate the programs is more communication oriented and not independent of the choice of the data set splitting and directory splitting. The feasible database system classes also ties the choice of the directory splitting to the choice of the data set splitting. Three choices to the data set splitting are centralizing, replicating, and partitioning. Each choice has the advantages and disadvantages as listed in table 1 [Ref. 1].

The directory is needed by the DBMS to locate the physical records in the data set. The placement of the directory components can affect system loading, availability, volume of communication links, response time, and overall system complexity [Ref. 1]. The directory can be centralized, distributed, or local. In the centralized directory location, regardless of the level of distribution of the data set, it is located in one computer complex. Subsets of the directory may be placed at local computer centers if subsets of the data set are stored locally. In the distributed directory location, the entire directory for the complete data set is stored at each local computer center. In local directory location, the portion of the directory associated with the local data set is stored in the local computer complex and that portion is not stored in any other computer installation. It is associated with the partitioned data sets. The characteristics of various combinations of data set distributions and directory distributions are summarized in table 2 [Ref. 1].

Table 2: Characteristics of Various Combinations of Data Set Distribution and Directory Location. Data Set refers to Data Base in the original copy.

Data Set Distribution	Directory Location		
	Centralized	Distributed	Local
Centralized	Feasible combination. Minimum Storage (1). Moderate Communications (2).	Feasible combination. Moderate Storage (6). Moderate Communications (2).	Not a feasible combination.
Replicated	Feasible combination. Moderate Storage (3). Moderate Communications (4).	Not a feasible combination.	Not a feasible combination.
Partitioned	Feasible combination. Moderate Storage (6). Moderate Communications (5).	Feasible combination. Moderate Storage (6). Moderate Communications (5).	Feasible combination. Minimum Storage (7). Minimum Communications (8).

(1) Depending upon the number of dispersed subsets of the directory.
(2) Depending upon data requests and processing against the data set.
(3) Depending upon the number of dispersed subsets of the directory and the number of existing copies of the data set, in whole or in part.
(4) Depending upon whether requesting and responding nodes are the same.
(5) Depending upon whether requesting and responding nodes are the same and whether directory changes are required.
(6) Depending upon the number of complete copies of the directory.
(7) Because the data set and directory are partitioned with no duplications.
(8) Because data sets needed locally are stored locally.

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A. HANKAM AND ITS MIS

1. Organization

As with other conventional organizations, the HANKAM Department was developed to achieve certain objectives. The HANKAM Department simplified organizational structure can be viewed in figure 3. Its goal is concerned with the achievement of national security in general. Its plan and the organizational structure reflect how the goal will be achieved.

In making the policy and developing the strategic plan, HANKAM Minister/Commander in Chief of the Armed Forces is supported by HANKAM General Planning Staff. Information is needed to perform their function. The information used in this level is primarily gathered from outside of the organization. The information from within the organization is a highly summarized one, the information that is generated firstly by the activities down below throughout the entire organization and filtered or summarized as it flows upward following the organization structural hierarchy.

The HANKAM functional staff responsibility is the management of some specific functional area in conjunction with the various resources to support the goal of the department. In running the department, the management of HANKAM is assisted by Supporting Activity Agencies such as Research and Development Agency, Data Processing Center, Training and
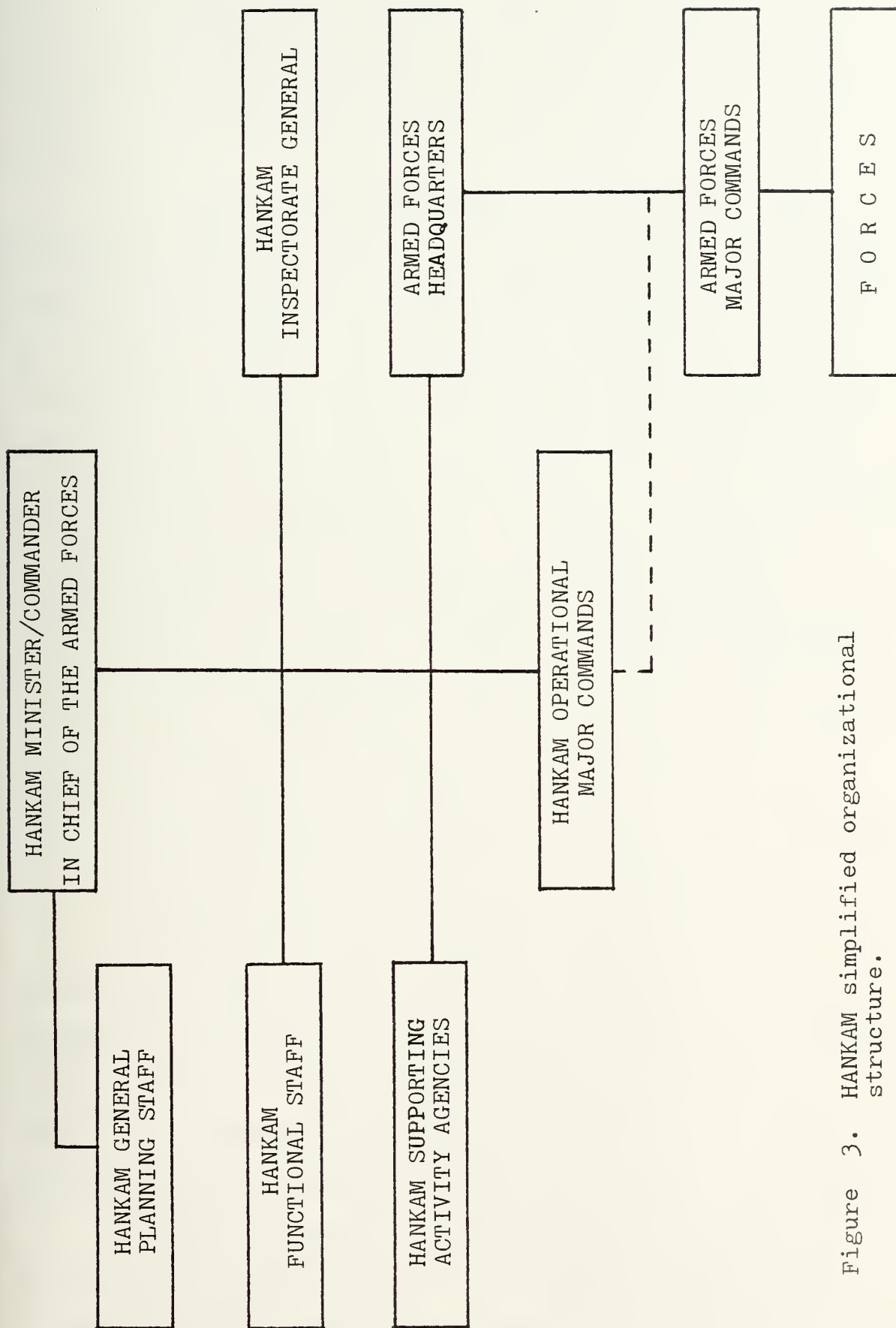
Figure 3. HANKAM simplified organizational structure.

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Education, Health and Medication, and many others. The
Inspectorate General conducts the department control
function to ensure that subordinates perform their functions
as intended.

To achieve the objectives of the department that
covers this wide area, the goal is broken apart into various
missions that should be accomplished by the HANKAM Operational
Major Commands and the Armed Services components, utilizing
resources available. The accomplishment of the mission is
their main objective. Each component of the Armed Forces
is responsible for managing and preparing the combat readiness
of their forces. For the Police, it is also subject to the
accomplishment of the law enforcement. The Indonesian deter-
rent strategy for security divides the national geographical
area into four compartments. The mission of each one of the
four HANKAM Operational Major Commands is concern with the
planning and operation of combat strategy of each compart-
ment. In accomplishing the mission, they are also supported
by the combat forces of the armed forces major commands.

The management of the HANKAM Department develops a
plan for the allocation of its resources among the various
missions in accordance with the national defense and security
policy. They measure and control what the allocation
actually is, observe and analyze the effect of the allo-
cation and adjust the allocation policy and plan as required.

The same management philosophy and principles are
also applied to the management at the armed forces level.
It has a similar organizational structure and procedures as

the HANKAN Department with its Inspectorate General, functional staff, supporting activity agencies, and major commands.

In summary, to perform their task, subordinates have authority delegated from their superiors. Decision making points are dispersed throughout the entire organization according to responsibility for mission accomplishment. Each level and function may have their own type of decision activities caused by the different nature of each individual mission.

2. Data Processing System and MIS

When considering an MIS we are faced with many disagreements about definitions. Head [Ref. 6] stated: "Definitions abound, but there is no consensus among the numerous contributors to the literature as to what really constitutes an MIS." For the purpose of this thesis, the author considers it as principally involving a system that provides information needed by the various levels and functions of management within the organization in their planning decision making process. However, it is worthwhile to consider the information system as a whole before discussing the MIS.

Regarding the way information is being collected, it can be divided into two classes, namely formal and informal information. Informal information is usually generated by personal contact and rumor. This type of information is widely used by upper level management especially concerning the information from outside of the organization. Since this information is poorly defined and unstructured in nature,

in using this information for a decision, the management is required to make estimates and judgements based on their experiences and to combine it with the formal information.

In a conventional organization formal information is collected through channels up and down in accordance with the organization hierarchical structure. The channels are embodied within this structure through the organization's procedures. The major part of this information is generated by the activities at the operational level of the organization. This channels work very effectively if used in the top-down fashion but not in the bottom-up direction. Management spends most of its time transforming information generated by the lower level management or subordinates into useful information needed by their superiors. Current technical discussions try to upgrade the effectiveness of this bottom-up version by utilizing computer capabilities which apply to MIS implementation.

In general, an information system of an organization can be categorized and visualized as in figure 4. Operating Information System (OIS) is the system that collects, maintains, and processes basic data required for record keeping and to support a decision making process. The part of OIS that transform raw data into one or more types of information is called Data Processing Information System (DPIS). The part of DPIS that processes data into information which is used to bring the system into a predetermined stable condition without direct human participation is called the
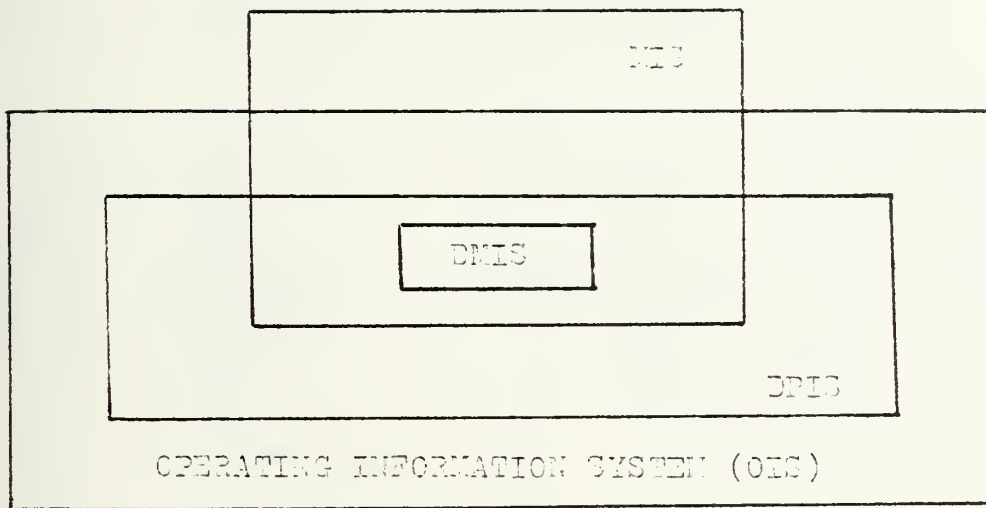
Figure 4. Categories of information systems.

Decision Making Information System (DMIS). Currently,
perhaps no organization possesses a DMIS. The MIS which is
used to maintain the dynamic control over the organization
consists of three parts. The first part is the one in accord-
ance with the information generated outside of the OIS and
mainly comes from outside of the organization. The second
part is the information generated by the OIS but not pro-
cessed by the DPIS, and the third part is the one processed
by DPIS. Our discussion in this thesis is primarily concerned
with the later which utilizes the database with its computer.
However, it does not mean that we can neglect the OIS as a
whole, since the data processed by the DPIS comes from the
other part of the OIS.

The major formal information flow for HANKAN which
is used in the planning and decision making process and for

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Figure 5. Major Formal Planning Information Flow for HANKAM Department.

record keeping can be visualized as in figure 5. The flow
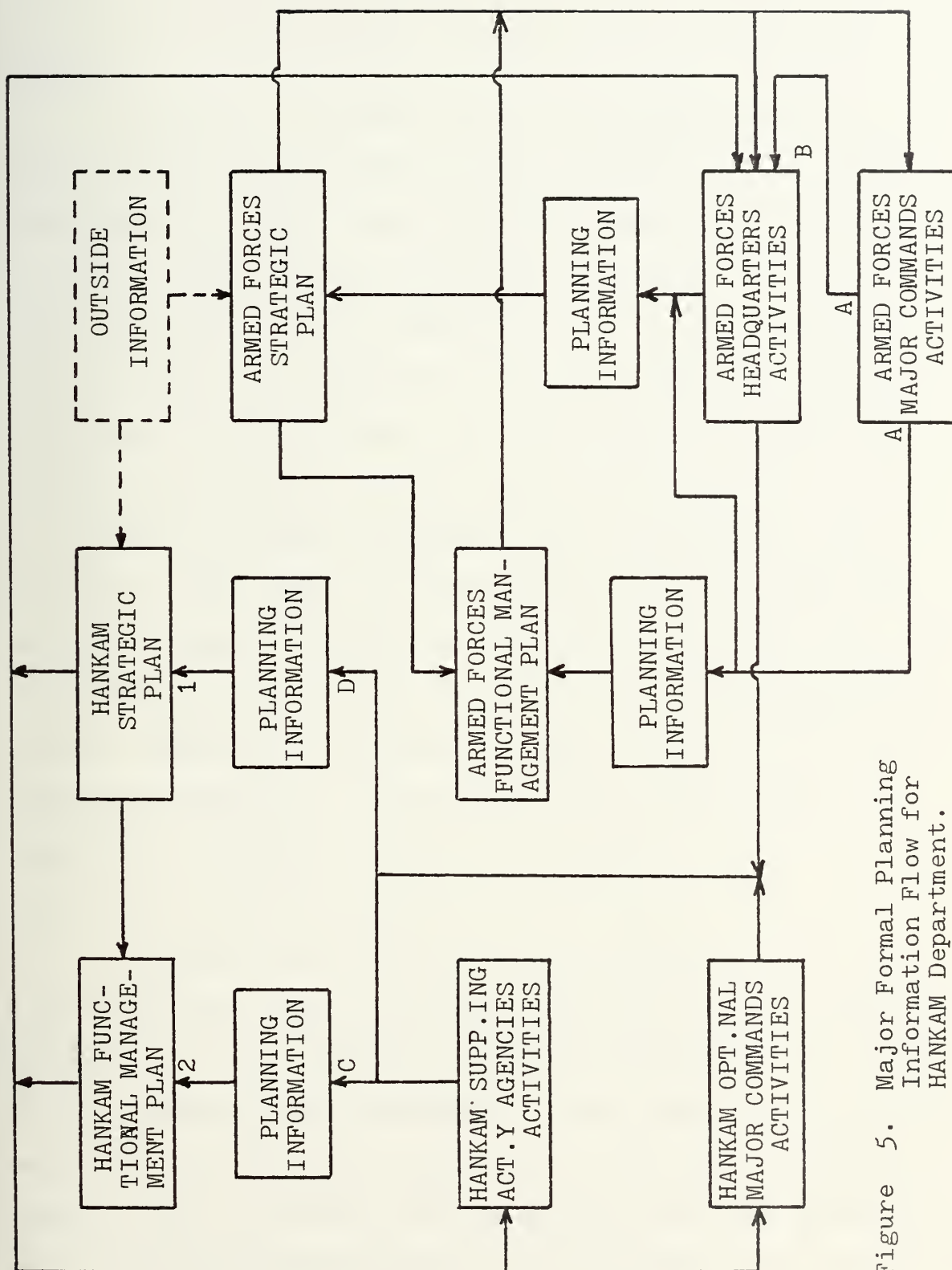following the organization's structure that is shown in
figure 3.

The HANKAM strategic plan is developed using two
major information sources, one from outside of the organi-
zation and the second from within the organization. The formal
part of the information that comes from within the organi-
zation will be a highly summarized one. It comes from the
activities of HANKAM Supporting Activity Agencies, HANKAM
Operational Major Commands, and Armed Forces Headquarters.
The same information sources also provide formal information
for HANKAM functional management for accomplishing their
functions. As a guide in developing the HANKAM functional
management plan, it refers to the HANKAM strategic plan. In-
formation that comes from the Armed Forces headquarters are
actually summarized information originating from their sub-
ordinates, namely the Armed Forces Major Commands and the
Supporting Activity Agencies of the Armed Forces. It follows
path A, B, C to 2, and path A, B, D to 1.

As mentioned earlier in the preceding section the
management must plan and conduct various activities regarding
the allocation of available resources and measure its effect
on the organization's performance. The basic resources that
are considered the most important by HANKAM management are:
people, money, material, and information that is relevant to
the national security strategy. It is reflected in the HANKAM
MIS, which is divded into four subsystems. They are the

personnel subsystem, financial subsystem, material subsystem, and combat strategy subsystem. Because of the different nature of the last subsystem in all aspects, it will not be discussed further.

The HANKAM Department has decided to develop and implement the MIS function. The authority for developing and implementing the HANKAM MIS function was given to one of the many HANKAM Supporting Activity Agencies. For the Armed Forces level, each service has its own organization, this is one of the Supporting Activity Agencies at the Armed Forces level.

In a manual system, the data processing function is embodied within the organization's hierarchical structure. Implementing a computerized information processing system implies the separation of the processing function from the management, consequently an independent data processing function is established. The degree of separation, thus the degree of control exercised over the new processing function, determines whether a data processing function is centralized, hierarchically distributed, or horizontally distributed.

Regardless of the operational data processing type, the formal planning information flow for HANKAM Department (Fig. 5) can be visualized as in figure 6. For the computerized system, the data processing function can be either centralized, hierarchically distributed, or horizontally distributed.
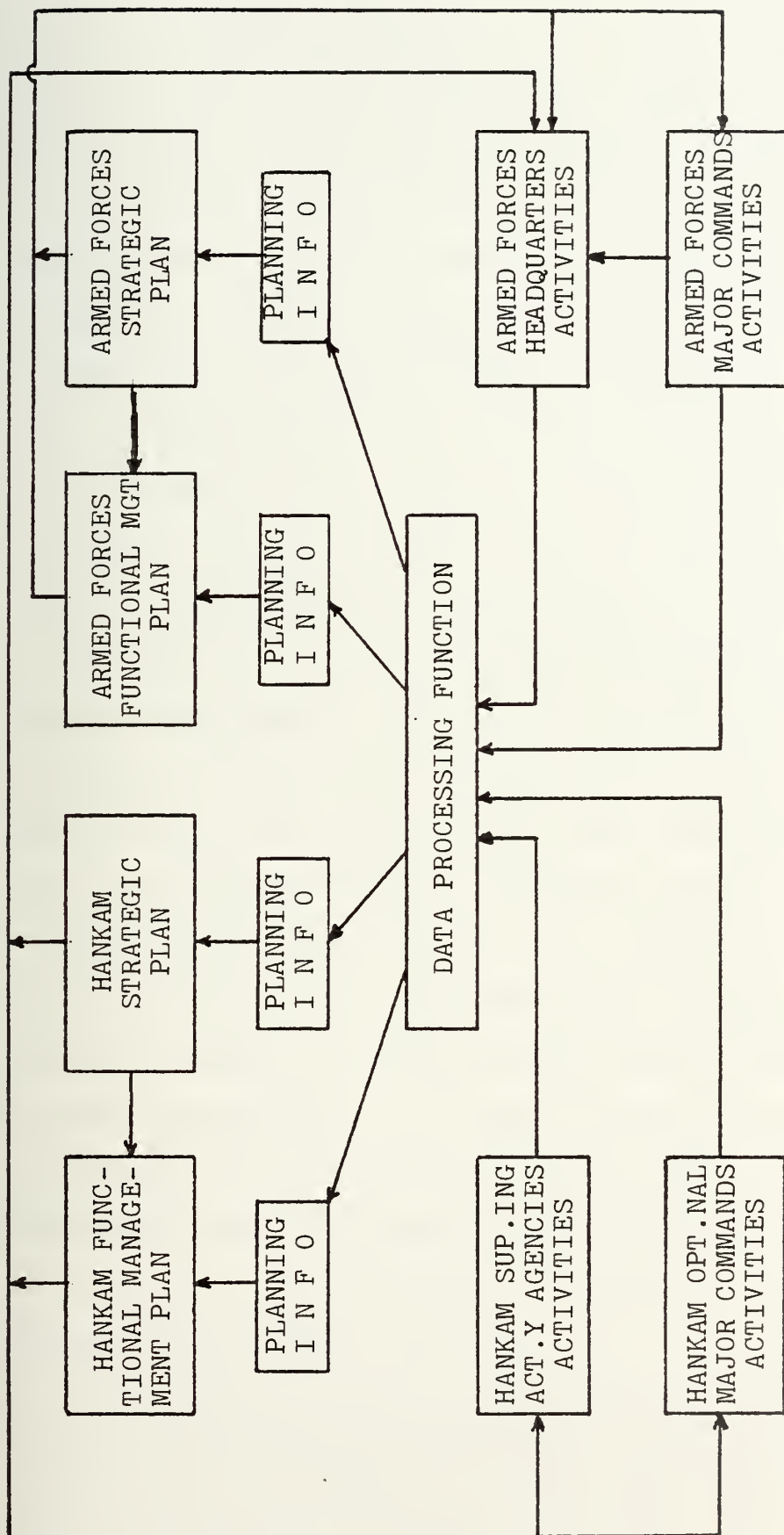
Figure 6. Computerized Information Flow for HANKAM/ARMED FORCES in planning process.

B. PEOPLE CONSIDERATIONS

When a new advanced technology is being introduced, it
is too often accompanied by mechanistic assumptions about
the organization and its human members [Ref. 7]. The problems
begin to arise and evolve when it comes into implementation
and operation where people are involved. While people have
the capability of being adaptable, resentment is likely to
occur if the adaptation is coerced and if it disturbs the pre-
ferred human system. During the early nineteenth century, the
industrial revolution created social change problems. The
unrest of employees at Lordstown is somewhat symbolic of the
new generation of workers who revolt against jobs which are
inhumanly dull and/or that involve inconsiderate pressure to
produce [Ref. 8]. Nolan identified a crisis somewhere in
stage three of his six stages of data processing growth, the
point where the EDP function changes become an MIS function.
This may impact significantly the continuation of system
growth [Ref. 9]. A significant impact on middle management
caused by certain MIS computer application cannot be tolerated
by some individuals. "....each incident of technology
transfer contains a fascinating story full of technological
complexity and human drama." [Ref. 10].

According to Dickson [Ref. 11], on the attempt to design,
develop, and implement an MIS:

"Such topics as project identification and selection,
project time and cost estimation, project control and doc-
umentation, and the entire area of operations management
were felt by the firms to be far less crucial than topics
involving people problems in some way. The conclusion is

inescapable that, in order to achieve the technical benefits of management information systems, the dysfunctional side effects stemming from behavioral problems must be minimized, and that any systems designer who gives a complete hardware description to his charge without suggesting or forecasting problems in the social system does a disservice to himself and to his organization.'

Some of the typical patterns of employee behavior that can adversely affect the success of an MIS project are aggression, projection, and avoidance. Table 3 summarizes the specific factors that may be most important in causing dysfunctional behavior in each organizational group [Ref. 11]. In the operating group, nonclerical personal refers to one that provides inputs to the system, and the clerical personnel refers to those that are closely related to the inputs that will be processed and converting them into outputs. Operating management group consists of first-line supervisors up to and including middle management.

The process in which a new technology is transferred from the existing research into useful actual operation is known as technology transfer. In technology transfer two stages can be identified: intellectual acceptance and putting it into practice during implementation. A worse problem occurs when the implementation affects the higher level of management. Reference 12 (p. 18 and p. 30) stated the dynamics of the transfer process within an organization:

Technological change and innovation occur as the result of complex sets of human interactions, information flows and transfers, individual and organizational creativity, and individual and organizational risk-taking and decision-making.

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Table 3:   Reasons for resistance to MIS (by working
            group).

	OPERATING		OPER-ATING MANAGE-MENT	TOP MAN-AGE-MENT
	NON OLER-ICAL	OLER-ICAL		
Threats to economic security		X	X	
Threats to status or power		X	X*	
Increased job complexity	X		X	X
Uncertainty or unfamiliarity	X	X	X	X
Changed interpersonal relationals or work patterns		X*	X	
Changed superior-subordinate relationships		X*	X	
Increase rigidity or time pressure	X	X	X	
Role ambiguity		X	X*	X
Feelings of insecurity		X	X*	X*

X = The reason is possibly the cause of resistance to
    MIS development.
X*= The reason has a strong possibility of being the
    cause of resistance.

    Change is the way of life. Resistance to change is
also a way of life. The only way that successful change
can take place is to overcome the resistance to it and
provide the proper organizational conditions to enhance
it.

    The HAMKAM Department has decided to develop an MIS

function and a Master Plan and a guide for the development

has been established. A five year program that is derived

from the Master Plan is reviewed and revised annually as

needed. The program contains phases of the implementation

which cover the four subsystems that will be based on the

computerized data processing system. Current development of

the various applications in each subsystem are mostly still

in the stage of system study and definition. Subordinates

cannot reject current and future stages of the development
formally. If there is any resistance to the past and future
stages of the development, it will be in some form from the
underground that is hard to visualize. The following are
suggestions that have been given by some authors to reduce
potential problems or resistance [Refs. 8 and 13]:

1) Some kind of education, formal or informal, should be
   given to the management group that will be affected
   by and involved in the development process and opera-
   tion of the CIS.

2) Individuals affected by computers would be sincerely
   invited to participate in the planning, designing, and
   implementation of computer applications.

3) Ideally there should be an organization-wide approach
   to the design of MIS, since all subsystems should be
   integrated to assure that the overall system will
   function in the best interest of the organization as
   a whole.

4) The levels of the MIS are planned to be responsive to
   the levels of responsibility in the organization.

5) MIS should not be installed unless the managers for
   whom it is intended are knowledgeable enough to eval-
   uate and participate with it rather than be controlled
   by it.

6) Use computerization as an opportunity to develop
   employees - not to reduce their importance or to get
   rid of them.

7) Determine with the employees affected by computers how the new system can provide them with more job freedom.

8) MIS planning should be a continuing effort, since organizations and information should be responsive to change.

9) Actual implementation can proceed by subsystems, since it probably would be impractical to implement all subsystems of the MIS simultaneously.

V. CONCLUSION

Undoubtedly, a database system with its processing capability is appropriate as part of the OIS in an MIS application. Which one of the many classes of the database systems to choose is primarily determined by the type of OIS. It can be either one of centralized data processing, distributed data processing, no distributed system. Unfortunately, there are no standard metrics to measure. It depends on the characteristics of the organization and the environment of the development process such as vendors, facilities, technical expertise, and many others.

For the HANKAM Department that builds the OIS from scratch, and does not have previous ADP experience, we should consider the people problems most seriously. We can identify and judge two major areas: reducing people problems and reducing non-people problems. The later can further be divided, in the context of HANKAM Department, into minimizing technical complexity and minimizing costs the OIS classes as in figure 7. The author assigns weights of 60% for people problems and 40% for non-people problems. From the figure it can be seen that distributed data processing is the best system for current HANKAM Department. The consequence is that we must have many stand alone database systems for each main decision point. This is confirmed with what is stated by the following [Ref. 3]:

Figure 7. CIS choosing by measuring the ease of its
implementation. The ratio of the people
problems to non-people problems is consid-
ered as six over four.

	Reduction of people problems	Reduction of com- plexity	Least cost	Total
Centralized Data Processing	15	8	9	32
Distributed Data Processing	23	7	6	36
Distributed System	22	5	5	32
TOTAL	60	20	20	100

A better way to think of data-base management systems is
that they form an infrastructure which will allow the cor-
poration's various schemas to grow and interlink over the
years, becoming more useful as they do so. Furthermore,
the schemas can grow without the prohibitive costs of re-
writing application programs, and schemas do not have to
be changed when the hardware is changed.

If schemas across the corporation are to be interlinkable
and transferable from one plant to another or from one
data-processing system to another, they should all be
written in the same data description language. At today's
state of the art, then, most corporations should not talk
about a corporate-wide data base but rather a corporate-
wide organizing principle which forms the structure for
data-base development. An essential of this principle is
that the schema description language and data dictionary
be standardized throughout the corporation.

In terms of the environment of the operational database

system, it means that having the evolution from distributed

data processing to a distributed system can be considered

later. Let the experimental or growing phase of distributed

system, which is a new technology, be pioneered by those

who have sufficient resources and related urgent needs. For

most organizations, especially the HANKAM Department, it is better not to utilize the distributed database system until its development is mature. The transition from a manual system to a computerized MIS, with a database system, represents a major improvement for the HANKAM Department. For the distributed data processing system chosen, by considering the personnel, financial, and material subsystems involved, the computerized information flow structure will look like that shown in figure 8. There will be five groups of databases, one for the HANKAM Department, and one for each of the four Armed Service components.

Each database group consists of mainly personnel database, financial database, material database, and integrated database. The integrated database will contain a data set supplied by the personnel, financial, and material databases. The relations of the data item are structured to provide fast response to ad hoc information requests by the general management. The personnel, financial, and material databases are designed for the related functional management. Data item of the HANKAM functional databases are supplied by the related Armed Services functional databases and by data from the HANKAM Supporting Activity Agencies and the HANKAM Operational Major Commands. The details of the HANKAM functional data set and schema may be different from the one in the Armed Service level.

With the structure that is shown in figure 8, the tailoring of the information generation and availability to the task at each decision point, as suggested by Nichols [Ref. 14] can be made available.
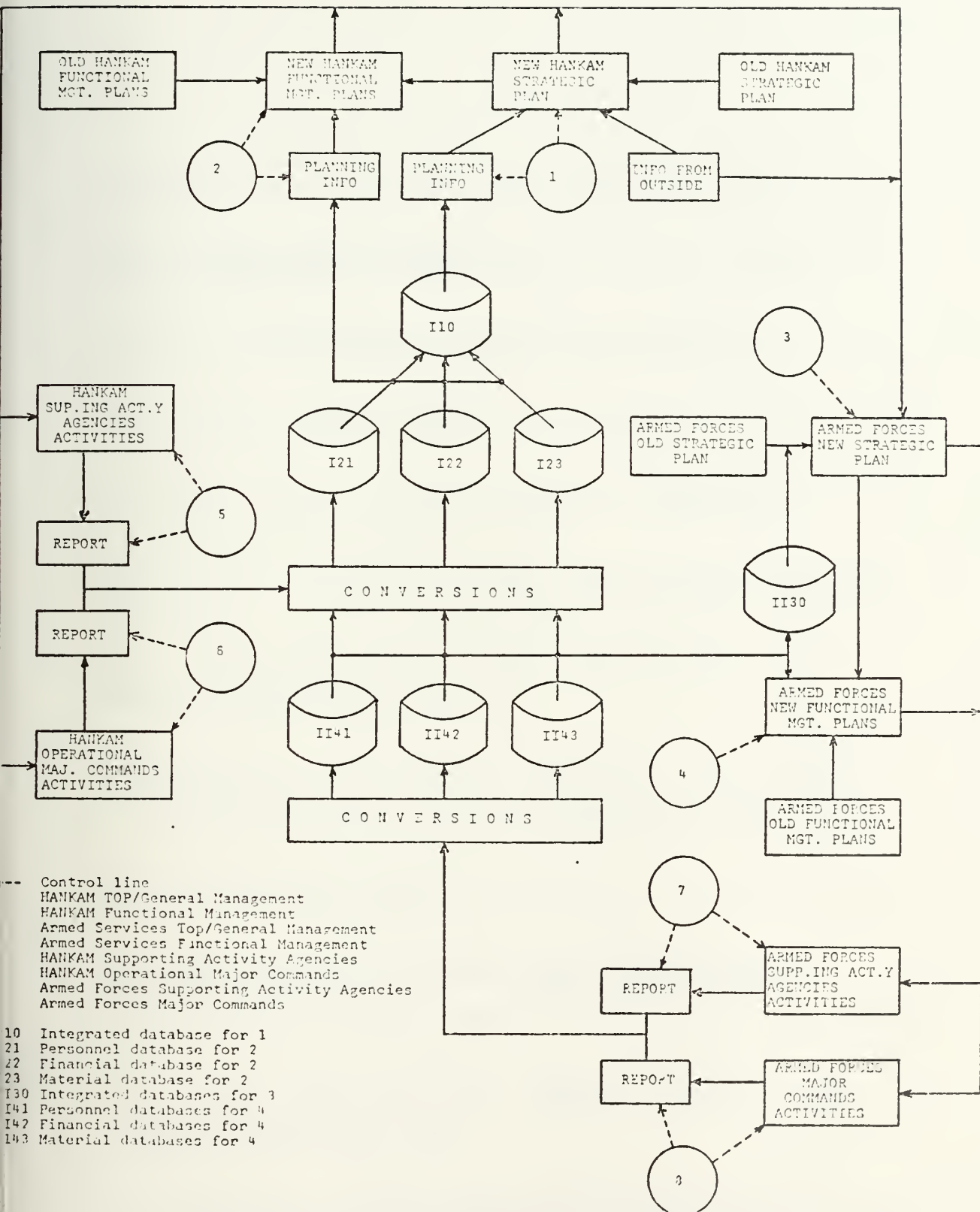
OLD HANKAM FUNCTIONAL MGT. PLANS

NEW HANKAM FUNCTIONAL MGT. PLANS

NEW HANKAM STRATEGIC PLAN

OLD HANKAM STRATEGIC PLAN

2

PLANNING INFO

PLANNING INFO

1

INFO FROM OUTSIDE

I10

3

HANKAM SUP.ING ACT.Y AGENCIES ACTIVITIES

I21   I22   I23

ARMED FORCES OLD STRATEGIC PLAN

ARMED FORCES NEW STRATEGIC PLAN

5

REPORT

CONVERSIONS

II30

6

REPORT

II41   II42   II43

ARMED FORCES NEW FUNCTIONAL MGT. PLANS

HANKAM OPERATIONAL MAJ. COMMANDS ACTIVITIES

CONVERSIONS

4

ARMED FORCES OLD FUNCTIONAL MGT. PLANS

7

-- Control line
HANKAM TOP/General Management
HANKAM Functional Management
Armed Services Top/General Management
Armed Services Functional Management
HANKAM Supporting Activity Agencies
HANKAM Operational Major Commands
Armed Forces Supporting Activity Agencies
Armed Forces Major Commands

REPORT

ARMED FORCES SUPP.ING ACT.Y AGENCIES ACTIVITIES

I10 Integrated database for 1
I21 Personnel database for 2
I22 Financial database for 2
I23 Material database for 2
I30 Integrated databases for 3
I41 Personnel databases for 4
I42 Financial databases for 4
I43 Material databases for 4

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ARMED FORCES MAJOR COMMANDS ACTIVITIES

8

Figure 8.   Computerized Information Flow
Structure for HANKAM MIS.

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